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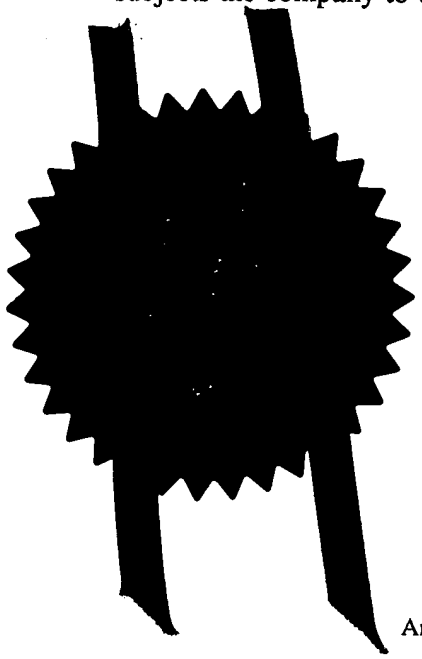

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Dated 16 NOV 2001

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Request for grant of a patent
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20 MAR 2001

The Patent Office
Cardiff Road
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1. Your reference — PHGB 010038

2. Patent application number
(The Patent Office will fill in this part) **0106842.8**

20MAR01 E615098-3 D02879
P01/7700 0.00-0106842.8

3. Full name, address and postcode of the or of each applicant (*underline all surnames*)

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THE NETHERLANDS

Patents ADP Number (*if you know it*) 07419294001

If the applicant is a corporate body, give the country/state of its incorporation — THE NETHERLANDS

4. Title of the invention — BEACON INFRASTRUCTURE

5. Name of your agent (*if you have one*)
"Address for service" in the United Kingdom to which all correspondence should be sent (*including the postcode*)

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Patents ADP number (*if you know it*) 07133473002

6. If you are declaring priority from one or more earlier patent applications, give the country and the date of filing of the or of each of these earlier applications and (*if you know it*) the or each application number

Country	Priority Application number (*if you know it*)	Date of filing (*day/month/year*)

7. If this application is divided or otherwise derived from an earlier UK application, give the number and the filing date of the earlier application

Number of earlier application	Date of filing (*day/month/year*)

8. Is a statement of inventorship and of right to grant of a patent required in support of this request? (*Answer "Yes" if:*
a) any applicant named in part 3 is not an inventor, or
b) there is an inventor who is not named as an applicant, or
c) any named applicant is a corporate body.
See note (d))

YES

9. Enter the number of sheets for any of the following items you are filing with this form.
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Continuation sheets of this form	
Description	8
Claims(s)	1
Abstract	1
Drawings	1

10. If you are also filing any of the following, state how many against each item:

Priority Documents

Translations of priority documents

Statement of inventorship and right to grant of a patent (*Patents Form 7/77*)

Request for preliminary examination and search (*Patents Form 9/77*)

Request for substantive examination (*Patents Form 10/77*)

Any other documents (*Please specify*)

11. I/We request the grant of a patent on the basis of this application.

Signature [signature] Date 17-03-01

12. Name and daytime telephone number of person to contact in the United Kingdom 01293 815438 (A. G. WHITE)

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DESCRIPTION

BEACON INFRASTRUCTURE

The present invention relates to mobile communications devices, such as telephones and suitably equipped personal digital assistants (PDA's), and to infrastructure systems and protocols for use with the same.

Recent years have seen a great increase in subscribers world-wide to mobile telephone networks and, through advances in technology and the addition of functionalities, cellular telephones have become personal, trusted devices. A result of this is that a mobile information society is developing, with personalised and localised services becoming increasingly more important. Such "Context-Aware" (CA) mobile telephones are used with low power, short range base stations in places like shopping malls to provide location-specific information. This information might include local maps, information on nearby shops and restaurants and so on. The user's CA terminal may be equipped to filter the information received according to pre-stored user preferences and the user is only alerted if an item of data of particular interest has been received.

Commonly-assigned United Kingdom patent application 0020099.8 filed 15th August 2000, describes a CA terminal and puts forward the concept of broadcasting data before a connection is made according to Bluetooth protocols. It exploits the Bluetooth Inquiry phase by extending the very short ID packet sent out during this mode and using the extra space thus gained to carry a small amount of information. This information can be Bluetooth system related data or one-way application data. This scheme has the potentially useful feature of being backwards-compatible with legacy Bluetooth devices that are not able to understand this extra field.

In accordance with the present invention there is provided a communications system as defined in the attached claims and in the following description.

The CA concept is about using a mobile handset to received special pushed messages from publicly located RF beacons. This proposal takes this idea further by suggesting a hierarchical arrangement of beacons which operate together in a co-ordinated system. A number of beacons are collected together to form a "Master Aura", within which services of a particular type are available from the operator owning the beacons. Some of the beacons are given the task of acting as "Initialisers". These special beacons are the first point of contact for handsets entering the Master Aura. They can receive identity and profile information from the handset, and pass this information on to initialise the other beacons in the Aura. Additionally, they may prime the handset with special sound files or other content relating to the user alerts that the handset may generate. By use of this procedure, whenever a handset moves near a beacon and receives a pushed message from it, it will already hold the appropriate resources to generate a specialised alert. This saves time and removes the need for duplex communication between a handset and a beacon. A further invention allows pre-load from the initialiser of interaction forms or scripts. If a user decides to follow up an alert and requests a WAP connection, the lengthy connection time is disguised by presented the user with the interaction forms.

Further features and advantages of the present invention will become apparent from reading of the following description of preferred embodiments of the present invention, given by way of example only, and with reference to the accompanying drawing, Figure 1, which is a schematic representation of an arrangement of beacons.

Many services and applications proposed for Context Aware (CA) support services that are pushed to the user. In the CA scenarios the user is wandering through a shopping mall and may receive pushed information including advertisements from shops, public transport information, personal information (friends alert), navigational information. Depending on the source of the information and the particular nature of the content, each push message can be given a class identification code. Based on that "class id" and other administrative fields in the message, the user's handset is capable of

performing filtering and sorting procedures on the data. This is done so that only messages which are considered relevant and desirable to the user in their current context are chosen for alerting to the user. The alerts themselves may take the form of sound clips, images, simple text or more complex modes such as handset vibration.

A problem with the CA concept is that it requires very low system latencies and the efficient processing of large numbers of messages. This invention solves some problems related to processing pushed messages in complex networks of beacons. Consider the arrangement of beacons in Figure 1.

Each beacon is represented by a dot, with the enclosing circle representing the range (or "Sub Aura") within which radio communication to a handset is possible. The beacon are arranged in two groups or "Master Auras", where each Master Aura represents a co-ordinated system providing a particular range of CA services and information. Our commonly-assigned United Kingdom patent application number 0020101.2, entitled "An Efficient Method for Delivering Services over Beacons", suggests novel arrangements of beacon devices. In that application, some beacons are "inquirers" which have the task of discovering handsets, and other beacons are interactors, which are responsible for the actual transmission of pushed messages. That arrangement is useful for speeding up the time for any given handset to form a connection to a beacon and receive information. The particular problem addressed by this application is related to the demands on a handset when it processes the information in a pushed message, with or without the above mentioned faster connection time modification.

It is important that the initial alert to the user is as appropriate as possible to the contents of the message. Any unnecessary ambiguity in the alert may distract the user, and cause them to waste time checking information that should have been alerted as of low priority. This would be very damaging to the user's perception of a service which must have low demands on the user's time if it is to be accepted. To this end a different sound can be related to each individual alert. This sound may be obtained from the nearest beacon

following reception of a pushed message. However, the time for this procedure could lead to an unacceptable delay, and an excessive load on an individual beacon. This problem is magnified if the alert relating to a particular message has either a number of variants, perhaps representing different priorities, or a number of components, perhaps an image as well as a sound.

The proposed solution to the problem is to organise beacons into groups of a number of beacons, each of which is co-ordinated as a single system for delivery of the messages of a particular operator. The current idea is distinguished in that the operator will select one or more of the beacons in a Master Aura to operate as "Initialiser" beacons. The Initialisers have the task of preparing a handset for interaction with any of the other beacons in the Aura. This could include any the following procedures:

Audio Alert Pre-load

Pre-load from the Initialiser beacon of the sound files which the handset should use for alerting the user to messages within the current Master Aura. This reduces the transmission overhead on individual beacon interactions, and means that they will be available for use immediately. A set of sound would be preloaded, maybe relating to different priorities of the same message (one sound for "urgent" another for "neutral"). Another ordering would have a different sound available for a particular class of alert (one sound relating to messages in Sub-Aura A, another for Sub-Aura B).

It could be appropriate for the Initialiser beacons to be located where first contact with handsets is expected, probably by the entrance or stairs leading to a new Master Aura. Each handset entering the Master Aura will now be "captured" and fully prepared for generating alerts whenever appropriate from that point onwards. Alternatively, "Initialiser" may just refer to an operating mode of a beacon, which any beacon in a Master Aura may switch to as required. Some kind of expiration lifetime will be necessary, so that resources allocated to the sound files can be freed when they are unlikely to be of further use (for example, a few minutes after the last contact with a beacon in a Master-Aura).

The audio alert pre-load idea is of greatest use for more advanced implementations of beacon networks which use broadcasting of pushed messages.

Message Pre-filter

Now that there is a hierarchy of beacons, with Master-Auras controlling Sub-Auras, there is the potential for message pre-filtering. With this concept, an Initialiser learns of the identity of a handset during its Initialisation communications. This identity can be passed on to all Sub-Aura beacons, along with some basic profile information downloaded from the handset. Individual beacons will then be able to filter potential messages so that only those which are relevant to the user's profile are transmitted. (Of course, this does not preclude further filtering on the handset side after reception of a pushed message).

Pre-load for Data Retrieval from Cellular Link

Another benefit of Initialisers can be found when a user decides to ask for more content relating to a message from a particular alert. At this point, the user gives the handset an indication that more information is required, possibly by a simple button press. This leads to the creation of an external cellular data connection, which is used to access relevant databases or web pages that can service the information request. The process of creating a data connection can take many seconds, perhaps 30 seconds for a normal WAP connection over GSM. This period of time is far too long for a user to endure without activity. However, the Initialiser scheme could be used to preload some content to the handset which can be displayed during the connection procedure. With appropriate planning, this content may even include user interaction, such as a WML menu for specifying more accurately the details of the information request. After 30s, the connection will have been made and these additional parameters from the user can be passed to the data provider. By having a task to perform, the user may not even have been aware of the delay.

One example embodiment is illustrated in Figure 1. Consider the arrangement of two Master-Auras as described above. Master Aura B in this case relates to a particular department store, and Master Aura A relates to

some unrelated location in which the handset is initially located. The handset moves along the path from A-B-C. At point A, it has no knowledge of the Shopping Centre Aura. As it reaches B, it comes into contact with the Initialiser beacon of the Shopping Centre. It passes its identity to that beacon, and some simple profile information. In return, it receives a set of three sound files, one for each of the other Sub Aura beacons. It also obtains a WML menu appropriate to a current promotion happening in the store.

On moving to C, the Sub Aura beacon detects the presence of the handset. This beacon, located perhaps in the toys department, uses the profile information it has received about the user (transferred from the initialiser) to design an appropriate push message. This is transmitted to the handset, and in this example offers the user a special offer on some computer games software. The handset decides that this class of message is appropriate for alerting to the user, and plays the relevant sound file that has been stored since contact with the initialiser beacon. The user decides that more information is desirable, and confirms this with a button push on the handset. At this point, a WAP connection is requested. During the connection period, the user fills in some details on a WML form which is presented from the handsets memory. Again, that form was stored since contact with the initialiser beacon. When the WAP connection is available, the additional parameters are passed in the information request to an appropriate URL. For the example, the added details may relate to the particular type of game the user wishes to buy, and how much they are willing to spend on this occasion.

This invention can be used in systems providing location aware services, such as could be found in places like shopping malls, airports, stations, conference centres, museums and sports venues.

In another example of the CA arrangement, the split beacon idea divides the phases of inquiry and interaction across different radios to speed up the inquiry process. The inquirer discovers a rolling list of valid Bluetooth handset device addresses, the list being passed on to the interactors for immediate data exchange. This list can be large: tens or even hundreds of

discovered devices passing a fixed inquirer eg at an entrance gate to an installed environment of beacons.

An interactor radio is thus given the job of polling those Bluetooth addresses on its list and guaranteeing the transmission of some data to those handsets. Unfortunately, this involves paging the devices in turn before data transmission. The simple paging mechanism itself can take about two seconds per device, and although there are some Bluetooth Special Interest Group proposals to speed paging up, it may still be of the order of a second per device. Therefore, in very crowded places of interaction, there is still a load problem . If paging takes one second, then only about eight devices can guarantee to be serviced (less with any significant data exchange per device) in the time it takes a walking user to pass out of the 10 metre range of the interactor radio (in time terms 5-8 seconds).

The particular feature is to cluster a number of interactor radios together in the same place and partition the allocation of the complete list of discovered Bluetooth handset addresses across the interactor radios. For example, the first radio handles first 5 device addresses, a second radio handles the next set, etc. So the cluster of radios might consist of 1 inquirer and 10 interactors together, to handle simultaneous interaction with 80 people in a 10 metre zone such as a train station concourse. According to the expected peak crowd numbers expected, then the number of radios required in a place can be estimated.

A further extension is possible when there is a geographical hierarchy of beacons, with some interactors serving non-overlapping zones, for example interactor number 5 does not overlap with the zone of interactor number 11. Now, some dynamic screening of the device address lists of the interactors can be performed. Any Bluetooth interaction with a device returns to the interactor radio (with v1.1 Bluetooth, not of course with connectionless-broadcasting) the handset device's ID, Bluetooth address with which it had that exchange. Knowing the layout of beacon coverage, it is therefore possible to say that if that handset is in range of interactor 5, then interactor 11 does not have to try to poll that Bluetooth address, and so on. The device address lists

ABSTRACT

BEACON INFRASTRUCTURE

A communications system comprising a plurality of beacons interconnected to form master auras within which services of a particular type are available from the operator owning the beacons.

(Figure 1)

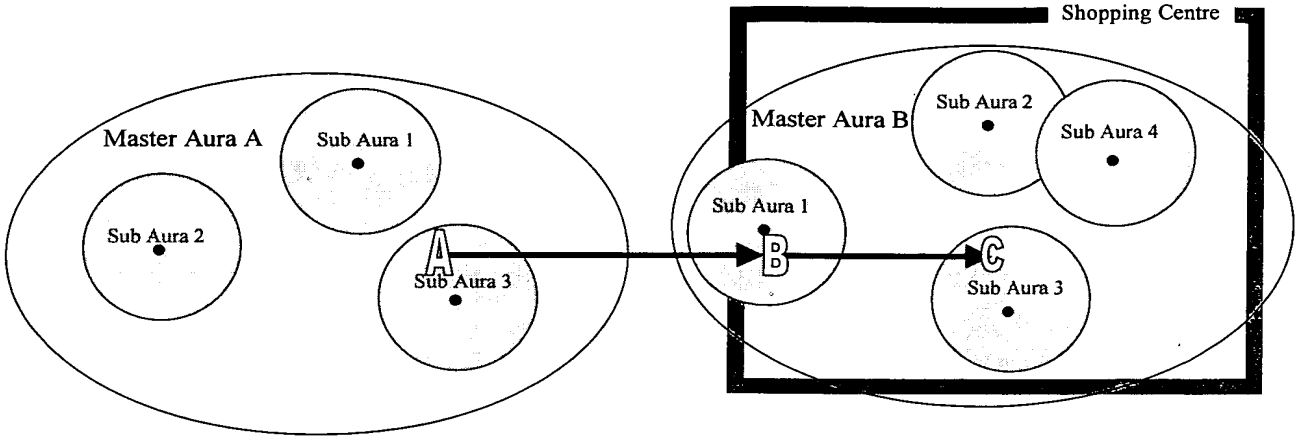
Shopping Centre
Master Aura A
Sub Aura 1
Sub Aura 2
Sub Aura 3
A
B
C
Master Aura B
Sub Aura 2
Sub Aura 4
Sub Aura 1
Sub Aura 3

FIG. 1